Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

Summer 2019

Pearson Edexcel GCSE (9 – 1)
In Mathematics (1MA1)
Higher (Calculator) Paper 2H

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GCSE (9 – 1) Mathematics – 1MA1
Principal Examiner Feedback – Higher Paper 2

Introduction

Students seemed to have become more accustomed to the new specification and were prepared well. Most students were able to access the majority of questions indicating centres entry strategy is well placed to support students.

On the whole it appears students were prepared with equipment, especially calculators and as a result they were not impeded with questions on topics such as trigonometry. Evidence showed that students are getting better at showing their working and this allowed examiners to award method and process marks even when the final answer was incorrect.

Report on individual questions

Question 1

Part (a) was answered relatively well; many students were able to solve the inequality. However, a significant proportion of students either made a mistake in the isolation of n, or used the wrong symbol in their answer. There were also a surprising number of students who got to $3n > 6$ but then had a final answer of $n > 3$.

Part (b) was generally poorly answered. A majority of students did not deal with the inequality first to get to x alone in the middle. These students typically plotted the inequality $-2 < x \leq 4$ to score one mark only. Most of those students who correctly worked with the inequality to rearrange it first to $-5 < x \leq 1$ went on to score full marks. Occasionally students used the wrong type of circles at the ends and scored two marks for the line connecting −5 and 1. A small number thought integers were needed and used −4 as a lower limit rather than −5 (losing 2 marks as they didn't show $-5 < x$).

Question 2

This linear graph question was incredibly well answered, with a great number of students scoring all three marks for the correct graph. Those who dropped marks did so for a variety of reasons, the most frustrating of which was when the correct line was plotted but not all the way from $x = -2$ to $x = 4$ as required by the question and thus scored two marks only. It was also relatively common to see students not correctly interpreting the scale on the x axis and, as a result, draw a graph with the wrong gradient but correct intercept. The mark scheme allowed such students to score two of the three marks. A few non-linear graphs were seen, and very few students used the space at the top to calculate values; those who did often got the values for y when substituting negative values of x wrong. Students need to learn how to use calculators to work with negative numbers.

Question 3

In part (i) almost all students correctly interpreted the table and scored both marks. When errors occurred it was usually down to premature rounding. There were a number of questions where this caused an issue and centres must reiterate the importance of not rounding until the end of a problem. A typical error seen every year is to write 1/3 as 0.3 and then proceed with an inaccurate calculation. A small number of students worked out 195/30 as 6.5 but then rounded this to 7 before working out 7 × 10.

Explain questions continue to challenge students, but part (ii) was answered quite well. Many students understood the important point about the sample being representative of the population and were able to gain the mark.

Question 4

This was the first problem type question on the paper and was answered very well. The problem required the students to carry out three steps which could be interchangeable in order, as the mark scheme shows. Typically, students followed the path of finding the total volume, then finding $\frac{2}{3}$ of this volume, before finally dividing by 275 and rounding down to find the number of cups. There were a number of errors that brought the loss of one or two marks. Some students worked with the total volume only and were able to score two marks at best. Others worked with $\frac{1}{3}$ rather than $\frac{2}{3}$ of the total volume. These students could gain three marks only. Finally there were the students who rounded the answer up to 9 rather than down to 8, again these lost the final mark. Alongside these problems, some students thought there was a need to convert units due to a misunderstanding of the conversion between cm^3 and millilitres. This was catered for in the mark scheme and students were still able to score all the process marks despite incorrect unit changes. Some students mis-interpreted this as a bounds question and calculated the volume as 30.5 × 6.5 × 19.5. Another incorrect method seen was to calculate the surface area of the cuboid instead of the volume, gaining no marks.

Question 5

As should be expected on the higher tier, the majority of students were able to gain both marks on this simple trigonometry question for a correct answer in range. Most students completed the question using the sine ratio, however some used a combination of other trigonometric ratios and Pythagoras's Theorem. Provided they didn't prematurely round their interim values, they ended with an answer in range and still gained both marks. As ever some students used the wrong ratio, and this typically meant zero marks. There were a small number of students who had their calculator set in radians; in this instance if the method was shown then the method mark could be awarded.

Question 6

It is clear that students have practised error intervals from rounding but not from a truncated number. This question was answered very poorly, with lots of students giving the answers of 8.25 and 8.35 which gained zero marks. Centres need to spend time on this new topic and ensure students know the difference between the two types of error interval.

Question 7

This question required students to find two parts of a four-part ratio using a multiplicative relationship. A good number of students were unable to do this and, as a result, failed to score on this question. Typically, those who were able to find the values for C and D in the ratio went on to score well. Most scored four marks, and of those who didn't, many scored three marks, only dropping the last mark as they calculated all four values and either identified the wrong one as the answer, or didn't identify one at all. With questions that involve dividing in a ratio, where only one value is required, students need to be clear of the need to identify which is the value required by the question. The most common incorrect method seen was to divide 360 by 9, which led to zero marks.

Question 8

Both parts of this question were answered very well, with the vast majority of students being able to correctly convert to and from standard form.

Question 9

Part (a) posed a challenge to many, including some of the highest achieving students. It goes to show that students still sometimes struggle to apply skills such as the relationship between length and area scale factors to unfamiliar situations. Most successful students started with a suitable ratio of the two circumferences, for example, 1 : 0.9 or more commonly 10 : 9. From here students had to square the values to achieve the ratio for areas, commonly seen as 100 : 81. The question didn't state that the ratio had to be in its simplest form so any equivalent ratio was acceptable for the accuracy mark.

Much like part (a), part (b) also caused problems. This time the first step was to write down a ratio of the two areas. Students struggled more with this first step than in part (a). Often 0.44 or 0.56 was used and no credit was given. Many students did not have the ratios the correct way round. Many appeared to think that f^2 was in fact greater than e^2. As in the previous part, once this first ratio was set up, the second mark was gained by applying knowledge of scale factors, in this case taking the square root to gain the ratio of lengths.

Question 10

As would be expected on the higher paper, the completion of the tree diagram was done very well, with a majority of students scoring both marks in part (a).

In part (b) many students scored the first mark for a suitable product, but then lost the remaining marks as their method was incomplete. This was usually because they dealt with the two possibilities of being late on exactly one day, but missed the words "at least" in the question, and failed to consider being late on both days. For those who gained the second mark, the third almost always followed.

Question 11

Cumulative frequency is generally a well answered question. Most students this summer were able to gain the mark in part (a) for correctly completing the table,

Of those who gained the mark in (a) almost all gained at least one mark in (b). Those who did drop a mark usually plotted at mid-interval values rather than the end of interval values. This was catered for in the special case on the mark scheme.

The success rate in (c) often depended on the success of (b), but not exclusively. Those who had the correct graph, almost always gained at least one mark for taking a correct reading from their cumulative frequency graph. Of these, a good proportion then dealt with this value correctly to find the correct percentage. There were a number of students who didn't use the graph to answer (c) and reverted to their table in (a). This method is not on the specification, but will have been seen by students studying GCSE Statistics, and so was catered for in the mark scheme, as the table would lead to the value of 74 and subsequently 6.

Question 12

This question required students to be able to link the area and perimeter of sectors. There were two main routes through the problem. The most popular was to find the angle of the sector using the formula for the area of a sector, and then to apply this to the arc length of a sector. This left simply the need to add 2 × 7 to finish the problem. The other common method was to work with proportion, for example $\frac{40}{49\pi}$ and then find this proportion of the circumference. Both these methods were regularly seen and used well. There was a simple first mark that almost all were able to achieve, for finding the area of the circle. Quite a large number of students dropped the final mark for failing to add the 2 × 7 to the arc length to complete the perimeter. Several wrong responses started with the angle being 110°, presumably from measuring. Students need to be aware of that, unless stated, diagrams are not accurately drawn.

Question 13

This algebraic fraction problem was answered quite well, with the majority of students attempting it, and most gaining at least some credit. The question had three steps of method and each was awarded a method mark. Students needed to factorise the given quadratic expression. This could be done at any stage. The second step was the need for a method to divide fractions, for example by multiplying by the reciprocal of the second fraction. The final step was to be able to add a fraction to an integer by using a common denominator. The first two steps were very commonly seen and for most, at least one mark was awarded. The division mark was often lost by failing to deal with the reciprocal of $(x+5)\times\frac{(x-1)}{"(x+5)(x-2)"}$ having cancelled the $(x + 5)$. The third mark was the hardest to achieve, with students regularly losing the addition sign and then multiplying in the last step. It was disappointing to see a number of those who, having gained the first three marks, then lose the final one by either failing to correctly simplify the numerator, or for adding denominators.

Question 14

This new topic was a challenge to many students. A large number failed to draw a tangent, often simply dividing the speed at $t = 15$ by 15, and so scored zero marks. Those who did draw a tangent then often scored all three marks. Some students took little care over the reading of the scales and therefore had an incorrect method for their gradient. It is important to realise that these questions need to have a tangent drawn. Several students gave an answer within the acceptable range, but they scored no marks as their answer clearly came from an incorrect method.

Part (ii) proved more challenging than the earlier one. This is a new topic and many students do not fully understand that gradients represent the instantaneous rate of change. In this context that being acceleration.

Part (b) brought in another new topic and students appeared better prepared than in previous series. However, the method for finding the area under the curve was often crude. Many students attempted to use rectangles, and whilst this does give an estimate, it is not a very good one. These students were able to score two marks typically for the processes, but their answer was usually outside the range given in the mark scheme. Students should be encouraged to use trapezia to find a better estimate. Many responses showed attempts to estimate distance using distance = speed × time. Many forgot to divide the triangle product for the first strip by two.

Question 15

At this stage in the paper, the algebra proved a challenge to many. That said, almost all students attempted this question, and a good number gained the first mark at least. Those who didn't get past the first mark, and there were a good number, struggled because they did not use a bracket when multiplying by "$m - 1$". This meant that from that point on their terms were incorrect as they had "-1" rather than "$-f$". As is often seen with these harder rearranging questions, many students failed to factorise once terms had been isolated and therefore lost the final mark.

Question 16

It is evident that most students have some knowledge of $y = mx + c$ and the properties of the gradients of perpendicular lines, but many got into trouble because of the form in which line L was given. A good number of students failed to rearrange the given equation to find the gradient, often working with 4. These students were able to gain the second mark, provided they had clearly stated the gradient of L as being 4. Failing to do that meant they could gain no credit for their knowledge of the properties of the gradients of perpendicular lines. The students who knew the relevant property often scored the second mark, however, quite a number forgot either the negative or the reciprocal and only used one of these aspects, meaning the second mark was not awarded. There was no prerequisite in the question regarding the form of the final equation, and as such, any equivalent equation was accepted for the accuracy mark.

Question 17

This explain question was probably the worst answered of the three. Most students realised that the number of cubes must be a multiple of 8 and 11 (the sum of the two ratios) but most missed the crucial part that 88 was the lowest common multiple. Without this acknowledgement, the mark could not be awarded.

Students generally struggled to find a way through part (b). Some used the structure of a two-way table or a probability tree, and when this was the case, were often successful. Most other students worked with numbers of cubes, but struggled to find one of the correct pairs that would lead them to the number of large yellow cubes.

Question 18

This circle theorem problem primarily required the knowledge of only one circle theorem that opposite angles in a cyclic quadrilateral add up to 180º – alongside some of the general geometric properties. It was split into two method marks, one accuracy mark and two communication marks. Most students gained the first mark for using the isosceles triangle to find either *BAD* or *BDA*. The second mark was for using cyclic quadrilaterals to find *BCD* or setting up an equation for *ABC* and *ADC,* also using cyclic quadrilaterals. The accuracy mark was then for the final two steps of method and getting to the correct value for *ADE*.
To gain all communication marks, students had to correctly state the circle theorem as well as one other correct property used. Alongside this, any other reasons stated need not be complete in terms of their wording, but must have been appropriate for the method that the individual used. If the award of both communication marks could not be made then one mark was available for either stating "opposite angles in a cyclic quadrilateral…", or for correctly giving all other reasons appropriate for their method. A common mistake in this question was to use a wrong circle theorem.

Question 19

3D trigonometry always poses a problem for all but the most able students, but again, it was good to see the majority of students attempting the problem, with most able to score at least one mark for either splitting *DA* in the correct ratio, or for using tan correctly to find *BE*. However, it is apparent that many students did not even know which angle they were trying to calculate. Also, several found *AE* which is not in the required triangle and so, on its own, was not enough for a mark. An impressive number of students were able to take the next step and have a correct process to find either *MB* or *ME* and gain two marks. It was at this stage that the vast majority of students struggled to get further, with many pupils incorrectly identifying and finding *EMA*. The final process mark was for a correct trigonometric statement involving angle *EMB*, which could be gained from numerous routes through the diagram.

Question 20

Even at this, the highest grade, a good number of students were not only attempting part (a) but gaining some credit. Many students scored one if not two marks in part (a) for a correct expression for $\overrightarrow{FE}$. The small number who gained one mark usually gave an answer of **a**–**b**+**a**+**b** which showed that the instruction to give the vector in its simplest form had been missed.

Part (b) proved to be a significant challenge for almost all students to solve using vector algebra. Some were able to gain the first mark, typically for finding $\overrightarrow{CE}$ or $\overrightarrow{FM}$. Very few students were then able to gain the second mark, involving the use of the correct scale factor, either $\frac{1}{n+1}$ or $\frac{n}{n+1}$. Of the few that did produce appropriate expressions, very few knew how to equate the coefficients to form an equation, and as a result only a very small minority of students were able to gain the full four marks using an algebraic method. Even students who converted the ratio n:1 into fractional amounts such as $n/(n+1)$ too often considered these fractions as vectors in their own right and would go on to write incorrect expressions such as **a**–**b** $+n/(n+1)$.

Summary

Based on their performance on this paper, students should:

- be encouraged to not prematurely round values within working, as this often leads to an answer outside of the acceptable range
- understand how to use their calculators when substituting negative values into formulae and expressions
- continue to spend time with new content especially topics such as error intervals for truncation, tangents and areas under graphs
- learn the correct language for giving geometric reasoning, without using abbreviated words
- remember to keep working inside the boxes provided or use an extra sheet to ensure working worthy of credit is seen.

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